

WHAT IS CLAIMED IS:

1. An isolated polynucleotide which encodes a polypeptide with sucrose synthase activity comprising a member selected from the group consisting of:

- 5 (a) a polynucleotide having at least 80% sequence identity, as determined by the GAP algorithm under default parameters, to a polynucleotide of SEQ ID NO: 1 or SEQ ID NO: 11;
- 10 (b) a polynucleotide encoding a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12;
- 15 (c) a polynucleotide amplified from *Zea mays* nucleic acids using primers which selectively hybridize, under stringent hybridization conditions, to loci within a polynucleotide of SEQ ID NO: 1 or SEQ ID NO: 11;
- 20 (d) a polynucleotide which selectively hybridizes, under stringent hybridization conditions and a wash in 0.1X SSC at about 65°C, to a polynucleotide of SEQ ID NO: 1 or SEQ ID NO: 11;
- 25 (e) a polynucleotide of SEQ ID NO: 1 or SEQ ID NO: 11;
- 30 (f) a polynucleotide which is complementary to a polynucleotide of (a), (b), (c), or (e); and
- 35 (g) a polynucleotide comprising at least 50 contiguous nucleotides from a polynucleotide of (a), (b), (c), (d), (e), or (f).

40 2. A recombinant expression cassette, comprising a member of claim 1 operably linked, in sense or anti-sense orientation, to a promoter.

45 25. A host cell comprising the recombinant expression cassette of claim 2.

50 30. A transgenic plant comprising a recombinant expression cassette of claim 2.

55 35. The transgenic plant of claim 4, wherein said plant is a monocot.

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6. The transgenic plant of claim 4, wherein said plant is a dicot.
7. The transgenic plant of claim 4, wherein said plant is selected from the group consisting of: maize, soybean, sunflower, sorghum, canola, wheat, alfalfa, cotton, rice, barley, millet, peanut, and cocoa.
8. A seed from the transgenic plant of claim 4.
9. A method of modulating the level of sucrose synthase in a transgenic plant, comprising:
 - (a) introducing into a plant cell a recombinant expression cassette comprising a polynucleotide of claim 1 operably linked to a promoter;
 - (b) culturing the plant cell under plant cell growing conditions;
 - (c) regenerating said transgenic plant; and
 - (d) expressing said polynucleotide, which results in production of an encoded protein, for a time sufficient to modulate the level of sucrose synthase in said plant.
10. The method of claim 9, wherein said plant is selected from the group consisting of: maize, soybean, sunflower, sorghum, canola, wheat, alfalfa, cotton, rice, barley, millet, peanut, and cocoa.
11. The method of claim 9, wherein the encoded protein comprises a member selected from the group consisting of:
 - (a) a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12;
 - (b) a polypeptide having at least 80% identity to, and having at least one epitope in common with, a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12, wherein said sequence identity is determined using the GAP algorithm under default parameters; and
 - (c) at least one polypeptide encoded by a member of claim 1.

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12. An isolated protein comprising a member selected from the group consisting of:
- a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12;
 - a polypeptide having at least 80% sequence identity to, and having at least one epitope in common with, a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12, wherein said sequence identity is determined by the GAP algorithm under default parameters; and,
 - at least one polypeptide encoded by a member of claim 1.
- 10 13. A method of increasing cellulose production in the stalk tissue of a transgenic plant, comprising:
- introducing into a plant cell a recombinant expression cassette comprising a sucrose synthase polynucleotide operably linked to a promoter;
 - culturing the plant cell under plant cell growing conditions;
 - regenerating said transgenic plant; and
 - expressing said polynucleotide for a time sufficient to increase the level of sucrose synthase in said plant.
- 15 14. The method of claim 13, wherein said plant is selected from the group consisting of: maize, soybean, sunflower, sorghum, canola, wheat, alfalfa, cotton, rice, barley, millet, peanut, and cocoa.
- 20 15. The method of claim 13, wherein said sucrose synthase polynucleotide is Sus1, Sh1, or Sus3 from maize.
- 25 16. The method of claim 13, wherein said promoter preferentially directs expression in stalk tissue.
- 30 17. A method of increasing the concentration of cellulose in the tissues of a seed of a transgenic plant, comprising:
- introducing into a plant cell a recombinant expression cassette comprising

a sucrose synthase polynucleotide operably linked to a promoter;
(b) culturing the plant cell under plant cell growing conditions;
(c) regenerating said transgenic plant; and
(d) expressing said polynucleotide for a time sufficient to increase the level of
5 sucrose synthase in said seed of said transgenic plant.

18. The method of claim 17, wherein said plant is selected from the group consisting of: maize, soybean, sunflower, sorghum, canola, wheat, alfalfa, cotton, rice, barley, millet, peanut, and cocoa.

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19. The method of claim 17, wherein said sucrose synthase polynucleotide is Sus1, Sh1, or Sus3 from maize.

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20. The method of claim 17, wherein said promoter preferentially directs expression in the seed.

21. The method of claim 17, wherein said promoter preferentially directs expression in the pericarp.

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